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 atc gat ccg cgc ggc gtt ctc ggc gag ttc ggg ctc gag ctg ccg gaa  
 528  
 Ile Asp Pro Arg Gly Val Leu Gly Glu Phe Gly Leu Glu Leu Pro Glu  
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 ggg gtc gag gtg cgc gtc tgg gac tcg acg gcg gag ctc cgg tat ctc  
 576  
 Gly Val Glu Val Arg Val Trp Asp Ser Thr Ala Glu Leu Arg Tyr Leu  
 180 185 190  
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 gtt ttg ccg gag cgg ccc gaa ggc acg gcg caa ctg agc gaa gaa gcg  
 624  
 Val Leu Pro Glu Arg Pro Glu Gly Thr Ala Gln Leu Ser Glu Glu Ala  
 195 200 205  
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 ctc gcg gat ctc gtc acc cgg gat gcc atg atc ggc gtc gcg aaa gtc  
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 Glu His Gln Ala Val Pro Ser Asp Leu Thr Leu Arg Val Lys Ser Leu  
 35 40 45  
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 Val Leu Val Asp Thr Tyr Glu Asn Lys Ile Gly Pro Arg Asn Gly Ala  
 65 70 75 80

5 Arg Val Val Ala Arg Ala Trp Val Asp Pro Ala Tyr Lys Glu Arg Leu  
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 Leu Lys Asp Ala Thr Ser Ala Ile Ala Glu Leu Gly Tyr Thr Gly Ala  
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 10 Gln Gly Glu His Met Val Ala Leu Glu Asn Thr Pro Ala Val His Asn  
 115 120 125  
 15 Leu Val Val Cys Thr Leu Cys Ser Cys Tyr Pro Trp Pro Val Leu Gly  
 130 135 140  
 20 Leu Pro Pro Val Trp Tyr Lys Ser Ala Pro Tyr Arg Ser Arg Ser Val  
 145 150 155 160  
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 165 170 175  
 25 Gly Val Glu Val Arg Val Trp Asp Ser Thr Ala Glu Leu Arg Tyr Leu  
 180 185 190  
 30 Val Leu Pro Glu Arg Pro Glu Gly Thr Ala Gln Leu Ser Glu Glu Ala  
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							80
	gag gcg gcg aat tcg ctg ggt cat gcg agc ccg gtc ggc agc cat ctg						
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	432						
40	Tyr Lys Ser Ala Ala Tyr Arg Ser Arg Val Val Ile Asp Pro Lys Gly		130		135		140
	gtc ctc gcc gag ttc ggc ctg acc ctg cca ccg gag acc ggg atc cgc						
	480						
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							160
	atc tgg gat tcg acc gcc gag acc cgg ttt ctg gtg gtg ccg atg cgg						
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 35 40 45

Phe Glu Thr Arg Ile Gly Pro His Ile Gly Ala Arg Ile Val Ala Arg  
 50 55 60

35 Ala Trp Ala Asp Ala Glu Phe Lys Arg Arg Leu Leu Ala Asp Ala Thr  
 65 70 75 80

40 Glu Ala Ala Asn Ser Leu Gly His Ala Ser Pro Val Gly Ser His Leu  
 85 90 95

45 Ile Ala Val Glu Asn Thr Pro Gln Thr His Asn Leu Val Val Cys Thr  
 100 105 110

50 Leu Cys Ser Cys Tyr Pro Trp Glu Val Leu Gly Leu Pro Pro Val Trp  
 115 120 125

Tyr Lys Ser Ala Ala Tyr Arg Ser Arg Val Val Ile Asp Pro Lys Gly  
 130 135 140

55 Val Leu Ala Glu Phe Gly Leu Thr Leu Pro Pro Glu Thr Gly Ile Arg  
 145 150 155 160

Ile Trp Asp Ser Thr Ala Glu Thr Arg Phe Leu Val Val Pro Met Arg  
165 170 175

5 Pro Pro Gly Thr Ala Gly Trp Ser Glu Glu Arg Leu Ala Glu Leu Val  
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96  
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144  
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35 40 45

45 ggg tgg ttc gtt ccg ttc tcg gcc agg ctc gcc cgg aaa ggc atc gct  
192  
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240  
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65 70 75 80

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288  
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85 90 95

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 336  
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 115 120 125

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 432  
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 130 135 140

cgc gcg gtg ctg ggc tat ccg ccg ttc tgg ttc aaa tcc gcc gcc tac  
 480  
 20 Arg Ala Val Leu Gly Tyr Pro Pro Phe Trp Phe Lys Ser Ala Ala Tyr  
 145 150 155 160

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 25 Arg Ala Arg Ala Val Arg Asp Pro Arg Gly Leu Ile Ala Glu Trp Gly  
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 576  
 30 Thr Met Leu Pro Asp Asp Val Arg Val Arg Val Val Asp Ser Thr Ala  
 180 185 190

gac tat cgc tgg atg gtt ctg ccg gtg cgg ccg gcc ggc act gcg ggc  
 624  
 35 Asp Tyr Arg Trp Met Val Leu Pro Val Arg Pro Ala Gly Thr Ala Gly  
 195 200 205

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 672  
 40 Trp Asp Glu Glu Arg Leu Ala Ala Ile Val Arg Glu Gly Asp Met Ile  
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 35 40 45  
 10 Gly Trp Phe Val Pro Phe Ser Ala Arg Leu Ala Arg Lys Gly Ile Ala  
 50 55 60  
 15 Pro Pro Ala Glu Ile Ala Glu Arg Ile Ala Val Thr Asp Arg Ala Ser  
 65 70 75 80  
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 85 90 95  
 Phe Arg Thr Leu Leu Leu Glu Asp Gly Thr Arg Ala Ala Glu Ser Leu  
 100 105 110  
 25 Gly Ile Met Met Arg Gly Ala Pro Pro Leu Gly Val Leu Glu Asn Thr  
 115 120 125  
 30 Pro Glu Ile His His Leu Val Val Cys Thr Leu Cys Ser Cys Tyr Pro  
 130 135 140  
 35 Arg Ala Val Leu Gly Tyr Pro Pro Phe Trp Phe Lys Ser Ala Ala Tyr  
 145 150 155 160  
 40 Arg Ala Arg Ala Val Arg Asp Pro Arg Gly Leu Ile Ala Glu Trp Gly  
 165 170 175  
 Thr Met Leu Pro Asp Asp Val Arg Val Arg Val Val Asp Ser Thr Ala  
 180 185 190  
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20 tat ctc gat ccc gcc gcg ctt gat gcg atg atc gaa gcc tac gag acg  
 96  
 Tyr Leu Asp Pro Ala Ala Leu Asp Ala Met Ile Glu Ala Tyr Glu Thr  
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25 cgg att ggg ccg cat aac ggc gcg cgc gtc gtc gcc aag gcc tgg tcc  
 144  
 Arg Ile Gly Pro His Asn Gly Ala Arg Val Val Ala Lys Ala Trp Ser  
 35 40 45

30 gac gcc gca ttc aag cga gcg ctg gtc gag gat gcg acc aag gcc gtg  
 192  
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35 cag tcg ttc ggc gtg gtc aat cgc gtc ggc gat cac ctg atc gcg gtc  
 240  
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 65 70 75 80

40 gag aac acg ccc acg ctg cac aac atc atc gtg tgc acg ttg tgc tcc  
 288  
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 85 90 95

45 tgc tat ccg tgg gaa gtg ctc ggc ctg ccg ccg gtc tgg tac aaa tcg  
 336  
 Cys Tyr Pro Trp Glu Val Leu Gly Leu Pro Pro Val Trp Tyr Lys Ser  
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50 gcg ccc tac cgc tcg cgc gcg gtc aac gac ccg cgc ggg gta ctc gcc  
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 115 120 125

55 gat ttc ggc ctg aag ctg gcg ccg gat atg caa atc cgt gtc tgg gat  
 432  
 Asp Phe Gly Leu Lys Leu Ala Pro Asp Met Gln Ile Arg Val Trp Asp  
 130 135 140

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 480  
 Ser Thr Ala Glu Thr Arg Phe Ile Val Leu Pro Met Arg Pro Ala Gly  
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 528  
 Thr Asp Gly Trp Ser Glu Glu Lys Leu Ala Ala Leu Val Thr Arg Asp  
 165 170 175  
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 35 40 45  
 40 Asp Ala Ala Phe Lys Arg Ala Leu Val Glu Asp Ala Thr Lys Ala Val  
 50 55 60  
 Gln Ser Phe Gly Val Val Asn Arg Val Gly Asp His Leu Ile Ala Val  
 65 70 75 80  
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 Glu Asn Thr Pro Thr Leu His Asn Ile Ile Val Cys Thr Leu Cys Ser  
 85 90 95  
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 Cys Tyr Pro Trp Glu Val Leu Gly Leu Pro Pro Val Trp Tyr Lys Ser  
 100 105 110  
 55 Ala Pro Tyr Arg Ser Arg Ala Val Asn Asp Pro Arg Gly Val Leu Ala  
 115 120 125  
 Asp Phe Gly Leu Lys Leu Ala Pro Asp Met Gln Ile Arg Val Trp Asp

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40	aag ggg ctg atc gcg acc gac gtg atc gat cgc gtg gta gca acg tac 144 Lys Gly Leu Ile Ala Thr Asp Val Ile Asp Arg Val Val Ala Thr Tyr 35 40 45		
45	gag aaa gaa gtc ggg ccg ctc aac ggc gct aaa gtc gtc gcg cgg gcc 192 Glu Lys Glu Val Gly Pro Leu Asn Gly Ala Lys Val Val Ala Arg Ala 50 55 60		
50	tgg acc gat ccg gag tac cgc cgc aga ctg ctc aag aac ggc acg gcg 240 Trp Thr Asp Pro Glu Tyr Arg Arg Arg Leu Leu Lys Asn Gly Thr Ala 65 70 75 80		
55	gcg att gcc gag ctg gga ttc ggc ggc ttg cag ggc gaa cac atg atg 288 Ala Ile Ala Glu Leu Gly Phe Gly Gly Leu Gln Gly Glu His Met Met 85 90 95		

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 Val Val Glu Asn Thr Pro Ser Val His Asn Val Ile Cys Cys Thr Leu  
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 384  
 Cys Ser Cys Tyr Pro Trp Pro Val Leu Gly Leu Pro Pro Ser Trp Tyr  
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 aag tcg ctg gcg tat cgt tgc cga atc gtg cgc gag ccg cgc gcc gtc  
 432  
 Lys Ser Leu Ala Tyr Arg Ser Arg Ile Val Arg Glu Pro Arg Ala Val  
 130 135 140  
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 ctc ggc gaa ttc ggc ctc gaa ttg ccc gaa acg gtg gaa gtc cgc gta  
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 528  
 Trp Asp Ser Ser Ala Glu Met Arg Tyr Leu Val Leu Pro Glu Arg Pro  
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 576  
 Ala Gly Thr Thr Glu Leu Ser Glu Ala Glu Leu Ala Ser Leu Ile Thr  
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20	Cys Ser Cys Tyr Pro Trp Pro Val Leu Gly Leu Pro Pro Ser Trp Tyr 115 120 125		
25	Lys Ser Leu Ala Tyr Arg Ser Arg Ile Val Arg Glu Pro Arg Ala Val 130 135 140		
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35	Trp Asp Ser Ser Ala Glu Met Arg Tyr Leu Val Leu Pro Glu Arg Pro 165 170 175		
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 144  
 Gly Phe Leu Asp Gln Val Gly Ser His Ala Ala Glu Ala Trp Ser Pro  
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 cga aac ggc gca cgg gtc gtg gcg cgg gcg tgg gtg gat ccc gag tac  
 192  
 Arg Asn Gly Ala Arg Val Val Ala Arg Ala Trp Val Asp Pro Glu Tyr  
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 cgg acg cgc ttg ctc gcc gac ggc acc gcc gcg tgc gcc gcg ctc ggc  
 240  
 Arg Thr Arg Leu Leu Ala Asp Gly Thr Ala Ala Cys Ala Ala Leu Gly  
 65 70 75 80  
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 Tyr Ala Gly Pro Gln Gly Glu Tyr Ile Val Val Leu Glu Asp Thr Leu  
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 336  
 Ala Val His Asn Val Ile Val Cys Thr Gln Cys Ser Cys Thr Ala Trp  
 100 105 110  
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 ccc gtg ctg ggg ctg ccg ccc gat tgg tac aag agt ccg gag tat cgc  
 384  
 Pro Val Leu Gly Leu Pro Pro Asp Trp Tyr Lys Ser Pro Glu Tyr Arg  
 115 120 125  
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 gcc cgc gtc gtg cgg gag ccg cga cgg gtg ctt cgc gaa atg ggc ctc  
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 Ala Arg Val Val Arg Glu Pro Arg Arg Val Leu Arg Glu Met Gly Leu  
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 480  
 Glu Leu Ser Glu Ser Val Thr Ile Arg Val Trp Asp Thr Thr Ala Glu  
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 528  
 Thr Arg Phe Leu Val Leu Pro Leu Arg Pro Ala Gly Thr Glu Gly Trp  
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 576  
 Ser Ala Glu Gln Leu Ala Ser Leu Val Thr Arg Glu Ala Met Ile Gly  
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 35 40 45  
 25 Arg Asn Gly Ala Arg Val Val Ala Arg Ala Trp Val Asp Pro Glu Tyr  
 50 55 60  
 30 Arg Thr Arg Leu Leu Ala Asp Gly Thr Ala Ala Cys Ala Ala Leu Gly  
 65 70 75 80  
 Tyr Ala Gly Pro Gln Gly Glu Tyr Ile Val Val Leu Glu Asp Thr Leu  
 85 90 95  
 35 Ala Val His Asn Val Ile Val Cys Thr Gln Cys Ser Cys Thr Ala Trp  
 100 105 110  
 40 Pro Val Leu Gly Leu Pro Pro Asp Trp Tyr Lys Ser Pro Glu Tyr Arg  
 115 120 125  
 45 Ala Arg Val Val Arg Glu Pro Arg Arg Val Leu Arg Glu Met Gly Leu  
 130 135 140  
 50 Glu Leu Ser Glu Ser Val Thr Ile Arg Val Trp Asp Thr Thr Ala Glu  
 145 150 155 160  
 Thr Arg Phe Leu Val Leu Pro Leu Arg Pro Ala Gly Thr Glu Gly Trp  
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25  
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 96  
 His Pro Gly Val Ala Lys Asp Glu Lys Val His Gly Tyr Tyr Gln Leu  
 20 25 30

30  
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 25 Arg Tyr Leu Val Leu Pro Met Arg Pro Ala Gly Thr Glu Gly Met Ser  
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25   Lys Gly Tyr Val Asp Pro Ala Ala Leu Asp Ala Ile Ile Asp Thr Tyr  
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30   Glu Thr Lys Ile Gly Pro Arg Asn Gly Ala Arg Val Val Ala Lys Ala  
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35   Trp Thr Asp Pro Glu Phe Ala Ala Arg Leu Lys Gln Asp Gly Ser Ala  
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40   Ala Val Ala Glu Leu Gly Tyr Gly Gly Arg Gly Gly Glu His Ile Val  
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45   Ala Cys Phe Asn Thr Pro Glu Glu His Asn Leu Ile Val Cys Thr Leu  
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50   Cys Ser Cys Tyr Pro Trp Pro Val Leu Gly Leu Pro Pro Val Trp Tyr  
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55   Lys Ser Pro Pro Tyr Arg Ser Lys Ala Val Ile Asp Pro Arg Gly Val  
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60   Leu Ala Asp Phe Gly Val Thr Leu Pro Glu Gly Gln Arg Ile Arg Val  
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65   Trp Asp Ser Thr Ala Glu Thr Arg Phe Ile Val Ile Pro Leu Arg Pro  
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144  
Gln His Gln Asp Leu Pro Ser Asp Leu Ala Leu Arg Val Lys Ser Leu  
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192  
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384  
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	ttg ccg ccg gtc tgg tac aag tcc gcg ccc tat cgg tct cgc gtg gtg		
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	atc gat ccg cga ggt gtg ctg cgc gag ttc ggc gtg gtg ctg ccg gac		
	528		
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	576		
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	Gln His Gln Asp Leu Pro Ser Asp Leu Ala Leu Arg Val Lys Ser Leu		
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Glu Ser Leu Leu Val Glu Lys Gly Leu Val Glu Arg Ala Ala Leu Asp  
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Ala Leu Val Asp Thr Tyr Glu His Lys Val Gly Pro Arg Asn Gly Ala  
 65 70 75 80

10

Arg Val Val Ala Arg Ala Trp Val Asp Pro Asp Tyr Lys Gln Arg Leu  
 85 90 95

15

Phe Ala Asn Gly Thr Ala Ala Val Ala Glu Phe Gly Tyr Ser Gly Ser  
 100 105 110

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Gln Gly Ala Asp Ile Arg Val Val Glu Asn Thr Ala Thr Val His Asn  
 115 120 125

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Leu Val Val Cys Thr Leu Cys Ser Cys Tyr Pro Trp Pro Val Leu Gly  
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Leu Pro Pro Val Trp Tyr Lys Ser Ala Pro Tyr Arg Ser Arg Val Val  
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Ile Asp Pro Arg Gly Val Leu Arg Glu Phe Gly Val Val Leu Pro Asp  
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His Ile Glu Val Arg Val Tyr Asp Ser Thr Ala Glu Gln Arg Tyr Leu  
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 115 120 125

45 agc tac cgc agc cgc aca gtg cgc gag ccg cgc gcg gtg ctc gcc gaa  
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 115 120 125  
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 130 135 140  
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 Tyr Gly Phe Asp Gly Glu Pro Lys Lys Val Leu Tyr Arg Val Arg Phe  
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 Arg Gln Lys Glu Val Trp Pro Ala Tyr Arg Gly Pro Ala His Asp Val  
 245 250 255  
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 atc gag atg gag att ttc gag cat tgg ctc gag ccg gcg cag agc cag  
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20 Ile Leu Val Leu Met Ser Ala Thr His Pro Lys Lys Arg Ala Ala Asp  
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25 Ile Gly Gly Asn Lys Ala Gly Ala Val Asp Thr Ala Asp His Gly Met  
 50 55 60

30 Lys Phe Trp Glu Arg Gln Ala Asn Ala Leu Arg Thr Ala Leu Arg Arg  
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35 Asn Gly Leu Met Ser Val Asp Glu Leu Arg Arg Ala Ala Glu Asp Leu  
 85 90 95

Gly Asp Arg Tyr Ala Lys Leu Glu Tyr Phe Glu Arg Thr Thr Phe Ala  
 100 105 110

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 115 120 125

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 145 150 155 160

55 Gly Lys Gln Asp Gly Gln Arg Leu Pro Ser Thr Tyr Thr Ala Ala Pro  
 165 170 175

Gly His Arg Phe Asp Val Gly Asp Arg Val Val Val Lys Arg Ser Asn  
 180 185 190

Pro Pro Gly His Arg Arg Thr Pro His Tyr Ile Arg Gly Lys Thr Gly  
 195 200 205

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Val Ile Glu Arg Ile Cys Gly Ala Phe Pro Asn Pro Glu Glu Leu Ala  
 210 215 220

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Tyr Gly Phe Asp Gly Glu Pro Lys Lys Val Leu Tyr Arg Val Arg Phe  
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Arg Gln Lys Glu Val Trp Pro Ala Tyr Arg Gly Pro Ala His Asp Val  
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 Arg Tyr Thr Ile Asp Ala Pro Ala Phe His Ser Pro Trp Glu Val Arg  
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 144  
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 288  
 Val Glu Lys Gly Val Val Thr Arg Glu Glu Leu Glu Thr Arg Ala Gln  
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 336  
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 35  
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 576  
 Phe Arg Ser Glu Asp Leu Trp Pro Asp Ser Ala Asp Ser Ala Leu Val  
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Thr Ile Glu Arg Asp His Gly Val Phe Val Phe Pro Asp Thr Asn Ala  
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 576  
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 624  
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 35 40 45  
 Asp Ala Ser Arg His Arg Ile Glu Arg Met Asn Ala Ala Asp Tyr Leu  
 50 55 60  
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 85 90 95  
 55 Ala Asp Gly Thr Pro Lys Ala Thr Pro Pro Leu Pro Ala Asp His Val  
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 Thr Ala Ile Leu Ala Ser Gly Phe Pro Ala Ser Arg Glu Ala Gly Ala  
 115 120 125



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 288  
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 85 90 95

tcg atg cgc gcc ggc gcc atg ttg ccg cgc acc ctg acc cag gcc gat  
 336  
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 100 105 110

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 384  
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 528  
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 576  
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 624  
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20	Ile	Asp	Ala	Gly	Arg	Ala	Ser	Leu	Glu	Ala	Leu	Pro	Pro	Leu	Ala	Tyr	50	55	60	
25	Leu	Gly	Ser	Ser	Tyr	Tyr	Arg	Arg	Trp	Phe	Leu	Gly	Leu	Glu	Ser	Arg	65	70	75	80
30	Leu	Leu	Leu	Arg	Gly	Leu	Val	Gly	Glu	Asp	Glu	Ile	Ala	Ala	Gly	Arg		85	90	95
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	Leu	Gly	Ala	Gly	Asp	Asp	Pro	Gln	Trp	Leu	Tyr	Ala	Val	Val	Phe	Pro		180	185	190
	Ala	Arg	Glu	Leu	Trp	Gly	Glu	Ala	Ala	Asp	Pro	Ala	Ile	Lys	Ile	Ser	195	200	205	
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gtc gca cgc ggg ttc gcg ggc gcc gat gaa ctc gcc gcg ggt cgc gca  
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 130 135 140

gcg acg cac act cgg ttg ccg cga tat gcg cgc ggc cat gtc ggc gtg  
 480  
 Ala Thr His Thr Arg Leu Pro Arg Tyr Ala Arg Gly His Val Gly Val  
 145 150 155 160  
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 atc gag gcg atc cgc ggt tgc cac gta ttt ccc gac tcg gtt gcg atc  
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 Ile Glu Ala Ile Arg Gly Cys His Val Phe Pro Asp Ser Val Ala Ile  
 165 170 175  
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 ggc gcc ggc gag aac ccg caa tgg ctt tat acg gtg gtg ttc gaa ggc  
 576  
 Gly Ala Gly Glu Asn Pro Gln Trp Leu Tyr Thr Val Val Phe Glu Gly  
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 cgc acg ctg tgg ggc gat agc gcc gat ccg acg ctt aag gtc tcg atc  
 624  
 Arg Thr Leu Trp Gly Asp Ser Ala Asp Pro Thr Leu Lys Val Ser Ile  
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 165 170 175

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Gly Ala Gly Glu Asn Pro Gln Trp Leu Tyr Thr Val Val Phe Glu Gly  
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gtg ttt gcg ctc aac atg ctc ggc atc ggg cgc gag ccc att ccg gtg  
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20	gag	ctc	gaa	acg	gat	cct	gat	cgc	cca	ctg	cca	agg	act	gat	aac	cct
	336															
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	576															
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	624															
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 245 250 255  
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 260 265 270  
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 ctg aaa cct gcg cga gcg gcg acc tca gca gca tcc ggc ggc gaa aaa  
 864  
 Leu Lys Pro Ala Arg Ala Ala Thr Ser Ala Ala Ser Gly Gly Glu Lys  
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 35 40 45  
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 Asp Ala Leu Arg His Arg Ile Glu Arg Ile Glu Pro Trp Arg Tyr Leu  
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20	gtt ttc gct ctg atg act ctc ggt atc ggg aag ctc ggc gcg tac aac 144 Val Phe Ala Leu Met Thr Leu Gly Ile Gly Lys Leu Gly Ala Tyr Asn 35 40 45
25	gcc gat gag tac cgc cac tcg atc gag cgg atg gat ccg gcc cac tac 192 Ala Asp Glu Tyr Arg His Ser Ile Glu Arg Met Asp Pro Ala His Tyr 50 55 60
30	ctt gcg gcg acg tac tac gag cgc atg ctc acc ggc gtc gca acg ctc 240 Leu Ala Ala Thr Tyr Tyr Glu Arg Met Leu Thr Gly Val Ala Thr Leu 65 70 75 80
35	ctc gtc gag aag aac gtc gtt gcc cgc gac gag ctc gaa gcg cgc gcc 288 Leu Val Glu Lys Asn Val Val Ala Arg Asp Glu Leu Glu Ala Arg Ala 85 90 95
40	ggc ggg ccc ttc ccg ctg tca cgg ccg gtg gcc gag cgg ccg acg gcg 336 Gly Gly Pro Phe Pro Leu Ser Arg Pro Val Ala Glu Arg Pro Thr Ala 100 105 110
45	gac ctt cgg ccc cag cca caa cca cgc ttc gcg gtc ggg gat cgg gtc 384 Asp Leu Arg Pro Gln Pro Gln Pro Arg Phe Ala Val Gly Asp Arg Val 115 120 125
50	gtc gtg cgc gac atc cac ccg gcc ggg cat act cgt gtg ccg cgc tac 432 Val Val Arg Asp Ile His Pro Ala Gly His Thr Arg Val Pro Arg Tyr 130 135 140
55	gtg cgg ggc aag cgc ggg acc gtc gtg cac gtc gcg ccg aaa ttc tcg 480 Val Arg Gly Lys Arg Gly Thr Val Val His Val Ala Pro Lys Phe Ser 145 150 155 160

ttc ccc gac acg gcc gcg cac ggg ctg acc cat cgg agc gag cac acg  
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 Phe Pro Asp Thr Ala Ala His Gly Leu Thr His Arg Ser Glu His Thr  
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 tat cac gtg gaa ttc gtc gcg agt gac ctt tgg gcc gac gtg gcc ggg  
 576  
 Tyr His Val Glu Phe Val Ala Ser Asp Leu Trp Ala Asp Val Ala Gly  
 180 185 190  
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 agc aat gag agc gta ctc gtg gac ctg tgg gac ggc tat ctg gag ggc  
 624  
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 Ala  
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 40 Val Phe Ala Leu Met Thr Leu Gly Ile Gly Lys Leu Gly Ala Tyr Asn  
 35 40 45  
 45 Ala Asp Glu Tyr Arg His Ser Ile Glu Arg Met Asp Pro Ala His Tyr  
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 Leu Ala Ala Thr Tyr Tyr Glu Arg Met Leu Thr Gly Val Ala Thr Leu  
 65 70 75 80  
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 Leu Val Glu Lys Asn Val Val Ala Arg Asp Glu Leu Glu Ala Arg Ala  
 85 90 95  
 55  
 Gly Gly Pro Phe Pro Leu Ser Arg Pro Val Ala Glu Arg Pro Thr Ala  
 100 105 110

Asp Leu Arg Pro Gln Pro Gln Pro Arg Phe Ala Val Gly Asp Arg Val  
 115 120 125

5 Val Val Arg Asp Ile His Pro Ala Gly His Thr Arg Val Pro Arg Tyr  
 130 135 140

10 Val Arg Gly Lys Arg Gly Thr Val Val His Val Ala Pro Lys Phe Ser  
 145 150 155 160

15 Phe Pro Asp Thr Ala Ala His Gly Leu Thr His Arg Ser Glu His Thr  
 165 170 175

Tyr His Val Glu Phe Val Ala Ser Asp Leu Trp Ala Asp Val Ala Gly  
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 195 200 205

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 1 5 10 15

acc gct ccc cac gaa ccg acc ttc tgg gaa aag cag gtg gac gcg atc  
 96

50 Thr Ala Pro His Glu Pro Thr Phe Trp Glu Lys Gln Val Asp Ala Ile  
 20 25 30

cac ggc ctg ctc ggc gat tcc aag cgc cgc atc acg ctg cgc gac gag  
 144

55 His Gly Leu Leu Gly Asp Ser Lys Arg Arg Ile Thr Leu Arg Asp Glu  
 35 40 45

aac cgc ctc tat atc gaa tcg ctc ggc gac gac gtc tac aac acg ctc  
 192



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&lt;223&gt; Metagenome - beta unit nitrile hydratase - M25A18

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 15 His Gly Leu Leu Gly Asp Ser Lys Arg Arg Ile Thr Leu Arg Asp Glu  
 35 40 45  
 20 Asn Arg Leu Tyr Ile Glu Ser Leu Gly Asp Asp Val Tyr Asn Thr Leu  
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 Gly Tyr Tyr Glu Arg Trp Thr Ala Ala Met Cys Arg Gln Leu Ile Asp  
 65 70 75 80  
 25 Lys Gly Val Leu Thr Gln Asp Glu Ile Asp Ala Lys Ile Ala Glu Leu  
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 30 Arg Ala Arg Gly Val Gly Ala Gly Arg Arg Arg Asn Gly Leu Gln Thr  
 100 105 110  
 35 Val Ser Ala Asp Leu Ala Ala Asp Leu Ala Ile Ala Pro Arg Phe Ala  
 115 120 125  
 40 Ala Gly Asp Arg Val Arg Val Arg Asp Asp Tyr Pro Pro Gly His Ile  
 130 135 140  
 Arg Thr Pro Val Tyr Val Arg Gly Lys Thr Gly Val Val Thr Arg Cys  
 145 150 155 160  
 45 Phe Gly Ala Phe Lys Asn Pro Glu Leu Leu Ala Ile Gly Lys Asp Gly  
 165 170 175  
 50 Leu Pro Lys Lys Ile Leu Tyr Glu Val Arg Phe Lys Gln Thr Asp Leu  
 180 185 190  
 55 Trp Pro Asp Tyr Ala Gly Pro Ala Thr Asp Thr Leu Leu Ile Asp Ile  
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25 cag atc gag aag gac gag tcg ccc ttc cat gcg cgc tgg gaa ggc cgg  
 96  
 Gln Ile Glu Lys Asp Glu Ser Pro Phe His Ala Arg Trp Glu Gly Arg  
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30 gcg caa gcg atg tac aac gcc att gcg gcc acg ggc aga ctg gtg ctt  
 144  
 Ala Gln Ala Met Tyr Asn Ala Ile Ala Ala Thr Gly Arg Leu Val Leu  
 35 40 45

35 ggc ggt aga ccc aca cgg gaa ggg ttc ccg ccg gcc gaa tat ctc cgc  
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 Gly Gly Arg Pro Thr Arg Glu Gly Phe Pro Pro Ala Glu Tyr Leu Arg  
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 Met Ser Tyr Tyr Glu Leu Gly Phe Arg Val Leu Val Glu Asp Leu Val  
 65 70 75 80

45 ctg aac ggt ttg gtg acg cgc gcg gaa atc acg agc ggc cgt ccg gca  
 288  
 Leu Asn Gly Leu Val Thr Arg Ala Glu Ile Thr Ser Gly Arg Pro Ala  
 85 90 95

50 aag ggg gct gca aag tcg acg ccc gca atc acc gcc gcc acc gcg cag  
 336  
 Lys Gly Ala Ala Lys Ser Thr Pro Ala Ile Thr Ala Ala Thr Ala Gln  
 100 105 110

55 gca tat atg ttc gcg ctc aaa tcg acc cgg cga gac gta ccg gtc acg  
 384  
 Ala Tyr Met Phe Ala Leu Lys Ser Thr Arg Arg Asp Val Pro Val Thr  
 115 120 125

gcg cgt ttc caa gtc ggt cag cgt gtg cgc gcg cgc aac atc aat ccg  
 432  
 Ala Arg Phe Gln Val Gly Gln Arg Val Arg Ala Arg Asn Ile Asn Pro

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5	Val Thr His Thr Arg Leu Pro Arg Tyr Ala Arg Gly Lys Phe Gly Val				
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	atc gaa cgt gac cac ggt gtt tac agg ttc gac gat tcc ttt gcc acg				
	528				
10	Ile Glu Arg Asp His Gly Val Tyr Arg Phe Asp Asp Ser Phe Ala Thr				
			165		170 175
	tcc ggc gac gag aag ccc cag cac gtt tat tct gtg cgc ttc gcg gcg				
	576				
15	Ser Gly Asp Glu Lys Pro Gln His Val Tyr Ser Val Arg Phe Ala Ala				
			180		185 190
	cgc gaa cta tgg ggc gaa gcc gcg ccg ccg cga gat gct gtc tat atc				
	624				
20	Arg Glu Leu Trp Gly Glu Ala Ala Pro Pro Arg Asp Ala Val Tyr Ile				
			195		200 205
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45					
	Ala Gln Ala Met Tyr Asn Ala Ile Ala Ala Thr Gly Arg Leu Val Leu				
			35		40 45
50					
	Gly Gly Arg Pro Thr Arg Glu Gly Phe Pro Pro Ala Glu Tyr Leu Arg				
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55	Met Ser Tyr Tyr Glu Leu Gly Phe Arg Val Leu Val Glu Asp Leu Val				
	65		70		75 80
	Leu Asn Gly Leu Val Thr Arg Ala Glu Ile Thr Ser Gly Arg Pro Ala				

	85	90	95
5	Lys Gly Ala Ala Lys Ser Thr Pro Ala Ile Thr Ala Ala Thr Ala Gln 100 105 110		
10	Ala Tyr Met Phe Ala Leu Lys Ser Thr Arg Arg Asp Val Pro Val Thr 115 120 125		
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20	Val Thr His Thr Arg Leu Pro Arg Tyr Ala Arg Gly Lys Phe Gly Val 145 150 155 160		
25	Ile Glu Arg Asp His Gly Val Tyr Arg Phe Asp Asp Ser Phe Ala Thr 165 170 175		
30	Ser Gly Asp Glu Lys Pro Gln His Val Tyr Ser Val Arg Phe Ala Ala 180 185 190		
35	Arg Glu Leu Trp Gly Glu Ala Ala Pro Pro Arg Asp Ala Val Tyr Ile 195 200 205		
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5  
 10  
 15  
 20  
 25  
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 50  
 55

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 144  
 Gln His Gln Asp Leu Pro Ser Asp Leu Ala Leu Arg Val Lys Ser Leu  
 35 40 45

gaa tcg ctg ctt gtc gag aag ggg ctg gtg gag cga gca gcg ctc gac  
 192  
 Glu Ser Leu Leu Val Glu Lys Gly Leu Val Glu Arg Ala Ala Leu Asp  
 50 55 60

gcg ctg gtg gac acc tac gag cac aaa gtc ggg ccg cga aac gga gcg  
 240  
 Ala Leu Val Asp Thr Tyr Glu His Lys Val Gly Pro Arg Asn Gly Ala  
 65 70 75 80

cgc gtt gtc gcg cgg gcc tgg gtt gac ccg gac tac aag caa cgg tta  
 288  
 Arg Val Val Ala Arg Ala Trp Val Asp Pro Asp Tyr Lys Gln Arg Leu  
 85 90 95

ttc gcg aac ggt acc gcc gca gtc gcg gag ttc ggc tac tcc ggc tcg  
 336  
 Phe Ala Asn Gly Thr Ala Ala Val Ala Glu Phe Gly Tyr Ser Gly Ser  
 100 105 110

cag ggc gct gac atc cgg gtc gtc gaa aac acg gcc act gta cat aac  
 384  
 Gln Gly Ala Asp Ile Arg Val Val Glu Asn Thr Ala Thr Val His Asn  
 115 120 125

ctc gtc gtg tgc acg ctg tgc tct tgt tat ccc tgg ccg gtg ctg ggc  
 432  
 Leu Val Val Cys Thr Leu Cys Ser Cys Tyr Pro Trp Pro Val Leu Gly  
 130 135 140

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 480  
 Leu Pro Pro Val Trp Tyr Lys Ser Ala Pro Tyr Arg Ser Arg Val Val  
 145 150 155 160

atc gat ccg cga ggt gtg ctg cgc gag ttc ggc gtg gtg ctg ccg gac  
 528  
 Ile Asp Pro Arg Gly Val Leu Arg Glu Phe Gly Val Val Leu Pro Asp  
 165 170 175

cat atc gaa gtg cgt gtc tat gac agc acg gcg gag caa cgc tat cta  
 576  
 His Ile Glu Val Arg Val Tyr Asp Ser Thr Ala Glu Gln Arg Tyr Leu  
 180 185 190

gtg ctg ccg gag cgg ccg gcc gga acc gaa aac ctg aca gaa gaa gcg  
 624  
 Val Leu Pro Glu Arg Pro Ala Gly Thr Glu Asn Leu Thr Glu Glu Ala  
 195 200 205

ctg gcg ctg ctg gtg acg cgc gac gcg atg att ggc gtg gcc aag gtc  
 672  
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Gly Gly Ala Ala Ile Pro Asp Leu Ala His Ala Ala Asp His Asp His  
 20 25 30  
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Gln His Gln Asp Leu Pro Ser Asp Leu Ala Leu Arg Val Lys Ser Leu  
 35 40 45  
 30

Glu Ser Leu Leu Val Glu Lys Gly Leu Val Glu Arg Ala Ala Leu Asp  
 50 55 60  
 35

Ala Leu Val Asp Thr Tyr Glu His Lys Val Gly Pro Arg Asn Gly Ala  
 65 70 75 80  
 40

Arg Val Val Ala Arg Ala Trp Val Asp Pro Asp Tyr Lys Gln Arg Leu  
 85 90 95  
 45

Phe Ala Asn Gly Thr Ala Ala Val Ala Glu Phe Gly Tyr Ser Gly Ser  
 100 105 110  
 50

Gln Gly Ala Asp Ile Arg Val Val Glu Asn Thr Ala Thr Val His Asn  
 115 120 125  
 55

Leu Val Val Cys Thr Leu Cys Ser Cys Tyr Pro Trp Pro Val Leu Gly  
 130 135 140  
 60

Leu Pro Pro Val Trp Tyr Lys Ser Ala Pro Tyr Arg Ser Arg Val Val  
 145 150 155 160  
 65

Ile Asp Pro Arg Gly Val Leu Arg Glu Phe Gly Val Val Leu Pro Asp  
 165 170 175

5 His Ile Glu Val Arg Val Tyr Asp Ser Thr Ala Glu Gln Arg Tyr Leu  
 180 185 190

Val Leu Pro Glu Arg Pro Ala Gly Thr Glu Asn Leu Thr Glu Glu Ala  
 195 200 205

10 Leu Ala Leu Leu Val Thr Arg Asp Ala Met Ile Gly Val Ala Lys Val  
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15 Ala Pro Pro Gly Gly Arg Gly  
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40 gcg ttg gcg atc tcg ttg caa gac cgt ggc gtg ttc acg cga gac gaa  
 96  
 Ala Leu Ala Ile Ser Leu Gln Asp Arg Gly Val Phe Thr Arg Asp Glu  
 20 25 30

45 tgg gcg gcg gca ctc ggc gat gaa atc aag aag gcg caa gct gcc ggc  
 144  
 Trp Ala Ala Ala Leu Gly Asp Glu Ile Lys Lys Ala Gln Ala Ala Gly  
 35 40 45

50 gat ccc gat acg ggc gag act tat tac cat cat tgg atg gca gcg ctc  
 192  
 Asp Pro Asp Thr Gly Glu Thr Tyr Tyr His His Trp Met Ala Ala Leu  
 50 55 60

55 gaa cgg ctg att gca gcc aag ggt gtt gcc gat acg cag acg ctc gcg  
 240  
 Glu Arg Leu Ile Ala Ala Lys Gly Val Ala Asp Thr Gln Thr Leu Ala  
 65 70 75 80

cgc aca cgc gac gcc tgg cag cac gcc tgt gcg cga acg ccg cat ggc  
 288

Arg Thr Arg Asp Ala Trp Gln His Ala Cys Ala Arg Thr Pro His Gly  
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5    gcg cca atc gag cta aga ccg gac gac ttc agg aat tga  
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25    Ala Leu Ala Ile Ser Leu Gln Asp Arg Gly Val Phe Thr Arg Asp Glu  
                             20                            25                            30

30    Trp Ala Ala Ala Leu Gly Asp Glu Ile Lys Lys Ala Gln Ala Ala Gly  
                             35                            40                            45

35    Asp Pro Asp Thr Gly Glu Thr Tyr Tyr His His Trp Met Ala Ala Leu  
           50                            55                            60

40    Glu Arg Leu Ile Ala Ala Lys Gly Val Ala Asp Thr Gln Thr Leu Ala  
       65                            70                            75                            80

45    Arg Thr Arg Asp Ala Trp Gln His Ala Cys Ala Arg Thr Pro His Gly  
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50    Ala Pro Ile Glu Leu Arg Pro Asp Asp Phe Arg Asn  
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 gcg att ccg cgc cgc aac ggc gag ccg gtc ttc gac gag cct tgg gaa  
 96  
 10 Ala Ile Pro Arg Arg Asn Gly Glu Pro Val Phe Asp Glu Pro Trp Glu  
 20 25 30  
  
 agt cgt gcg ttt ggg ata gcg gtc gcc ctt tcc gag ggt ggc ctc tat  
 144  
 15 Ser Arg Ala Phe Gly Ile Ala Val Ala Leu Ser Glu Gly Gly Leu Tyr  
 35 40 45  
  
 tca tgg gat gaa ttt cgc gat tgc ctg att gct gaa atc aca gcg gcg  
 192  
 20 Ser Trp Asp Glu Phe Arg Asp Cys Leu Ile Ala Glu Ile Thr Ala Ala  
 50 55 60  
  
 gat gcg cgc ggc gag cat acg agc tat tac gaa cgg ttt ctc gcc gcc  
 240  
 25 Asp Ala Arg Gly Glu His Thr Ser Tyr Tyr Glu Arg Phe Leu Ala Ala  
 65 70 75 80  
  
 ctg cag cat ctg ctc gcg gcc aaa cgc ctc tgc act ccc gat gaa gtc  
 288  
 30 Leu Gln His Leu Leu Ala Ala Lys Arg Leu Cys Thr Pro Asp Glu Val  
 85 90 95  
  
 gag cgg cgg atg aac act agc gca ggc acc tga  
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 35 Glu Arg Arg Met Asn Thr Ser Ala Gly Thr  
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 Ser Arg Ala Phe Gly Ile Ala Val Ala Leu Ser Glu Gly Gly Leu Tyr  
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Ser Trp Asp Glu Phe Arg Asp Cys Leu Ile Ala Glu Ile Thr Ala Ala  
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 Asp Ala Arg Gly Glu His Thr Ser Tyr Tyr Glu Arg Phe Leu Ala Ala  
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40 gac cta ccg caa ctt cca agc gac acc gac ggc ccc gtc ttc gcg gaa  
 96  
 Asp Leu Pro Gln Leu Pro Ser Asp Thr Asp Gly Pro Val Phe Ala Glu  
 20 25 30

45 cct tgg gaa gcg gaa gcg ttt gcg ctt gcc gta agt ctt tca gag caa  
 144  
 Pro Trp Glu Ala Glu Ala Phe Ala Leu Ala Val Ser Leu Ser Glu Gln  
 35 40 45

50 gga cat ttc acg tgg aag gaa tgg gca gca acg ctc gcc gat gaa ctg  
 192  
 Gly His Phe Thr Trp Lys Glu Trp Ala Ala Thr Leu Ala Asp Glu Leu  
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 240  
 Glu Gly Ala Ala Asn Arg Gly Glu Pro Asp Asp Gly Thr His Tyr Tyr  
 65 70 75 80

gag tac tgg ctg acg gcc ctg gaa agg ctg gtt acg atc aag ggc ctg  
 288  
 Glu Tyr Trp Leu Thr Ala Leu Glu Arg Leu Val Thr Ile Lys Gly Leu

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	tat cgc cat acc ccg cat ggc gcg cca gtt gaa ctt atg tct ccg ctc		
	384		
10	Tyr Arg His Thr Pro His Gly Ala Pro Val Glu Leu Met Ser Pro Leu		
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35	Pro Trp Glu Ala Glu Ala Phe Ala Leu Ala Val Ser Leu Ser Glu Gln		
	35	40	45
40	Gly His Phe Thr Trp Lys Glu Trp Ala Ala Thr Leu Ala Asp Glu Leu		
	50	55	60
45	Glu Gly Ala Ala Asn Arg Gly Glu Pro Asp Asp Gly Thr His Tyr Tyr		
	65	70	75
	Glu Tyr Trp Leu Thr Ala Leu Glu Arg Leu Val Thr Ile Lys Gly Leu		
50	85	90	95
	Thr Asp Gln Gln Ala Met Arg Glu Arg Lys Glu Ala Trp Glu Glu Ala		
	100	105	110
55	Tyr Arg His Thr Pro His Gly Ala Pro Val Glu Leu Met Ser Pro Leu		
	115	120	125

Asp Gln Ser Arg Ile Ala Glu Glu Asp Ser Glu Ser Ser  
130 135 140